1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Bluewater Gas Storage, LLC (Bluewater) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emission test program on the C195 Oxidizer at the Bluewater Gas Storage Station located in Columbus, Michigan. The test was conducted to satisfy the requirements of the Michigan Department of Environmental Quality (MDEQ) PTI 77-14A.

The specific objectives were to:

- Determine the THC destruction efficiency (DE) of one oxidizer designated C195
- Conduct the test program with a focus on safety

Montrose performed the test to measure the emission parameters listed in Table 1-1.

TABLE 1-1
SUMMARY OF TEST PROGRAM

Test Date	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
12/9/20	Oxidizer C195 Outlet	Velocity/Volumetric Flow	EPA 1 & 2	3	≥ 6
		O_2, CO_2	EPA 3	3	60
		Moisture	EPA 4	3	60
		THC	EPA 25A	3	60
12/9/20	Oxidizer C195 Inlet*	Velocity/Volumetric Flow	EPA 1 & 2	3	10
		THC	EPA 25A	3	60

*Due to the complex nature of the inlet gas stream, a bag sample was collected for compositional analysis following ASTM D1946. The molecular weight determined from the analysis was used for inlet flow rate calculations. In addition, the inlet moisture content was calculated based on the saturation point.

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

TABLE 1-2
SUMMARY OF AVERAGE DESTRUCTION EFFICIENCY RESULTS - C195
DECEMBER 9, 2020

Parameter/Units	Average Results[1]	Emission Limits
Outlet THC, as Propane		
ppmvw	< 2.00	--
lb/hr	< 0.012	--
THC Destruction Efficiency, %	99.9	95%

[1]Average values labeled as 'less than' identify compounds reported at the method detection limit (MDL).

1.2 KEY PERSONNEL

A list of project participants is included below.

Facility Information

Source Location:	Bluewater Gas Storage, LLC Bluewater Gas Storage Station 333 S. Wales Center Columbus, MI 48063	
Project Contact:	Shelly Heston	Frank Rasmussen
Company:	WEC Energy Group	Bluewater Gas Storage
Telephone:	920-433-1294	810-305-3912

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC
Contact:	Brandon Check
Title:	Client Project Manager
Telephone:	630-860-4740
Email:	bcheck@montrose-env.com

Laboratory Information

Laboratory:	GTI Testing Laboratories
City, State:	Des Plaines, Illinois
Method:	ASTM D1946

Test personnel and observers are summarized in Table 1-3.

TABLE 1-3
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Brandon Check	Montrose	Client Project Manager/QSTI/Field Team Leader/Trailer Operator
Matthew Libman	Montrose	QSTI/Sample Recovery/Sample Train Operator
Kurt Wepprecht	Montrose	Sample Train Operator/Velocity Measurements
Debbie Olsen	Montrose	Report Preparation
Shelly Heston / Frank Rasmussen	WEC Energy Group / Bluewater	Client Liaison/Test Coordinator

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The Dehydration Unit has a 3.26 MMBtu/hr reboiler and a .85 MMBtu/hr oxidizer. The unit has a max glycol recirculation rate of 8 gal/min and has a dry gas flow of up to 465 MMscf/day.

As part of the withdrawal process, water/humidity must be removed from the natural gas. To accomplish this a glycol dehydration system that includes a glycol reboiler is used. Emissions from reboiling the glycol are controlled using a thermal oxidizer.

2.2 FLUE GAS SAMPLING LOCATIONS

Information regarding the sampling locations is presented in Table 2-1.

TABLE 2-1
SAMPLING LOCATIONS

Sampling Location	Duct Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
C195 Inlet	4	104 / 26	104 / 26	Flow: 1 (center)
C195 Outlet	17.75	60 / 3.38	240 / 13.52	Flow: 16 (8/port)

Sample locations were verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed using EPA Method 1, Section 11.4. See Appendix A.1 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the source and air pollution control devices were operating at the conditions required by the permit. A summary of the process data is presented in Table 2-2. Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B.

TABLE 2-2
PROCESS DATA

Run	Dry Gas Flow (MMscf/day)	Glycol Flow Rate (gal/min)	Oxidizer Temp (°F)	Retention Time (seconds)
1	227.04	4.69	1,400.27	0.72
2	225.86	4.68	1,390.01	0.77
3	226.24	4.68	1,383.13	0.78

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

The sample port and traverse point locations are detailed in Appendix A.1.

3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1. The molecular weight of the gas stream is determined from independent measurements of O_2, CO_2, and moisture. The stack gas volumetric flow rate is calculated using the measured average velocity head, the area of the duct at the measurement plane, the measured average temperature, the measured duct static pressure, the molecular weight of the gas stream, and the measured moisture.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - S-type pitot tube coefficient is 0.84

3.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to measure the percent O_2 and CO_2 in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2 and percent O_2 using either an Orsat or a Fyrite analyzer.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - An Orsat analyzer is used to measure the analyte concentrations

3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

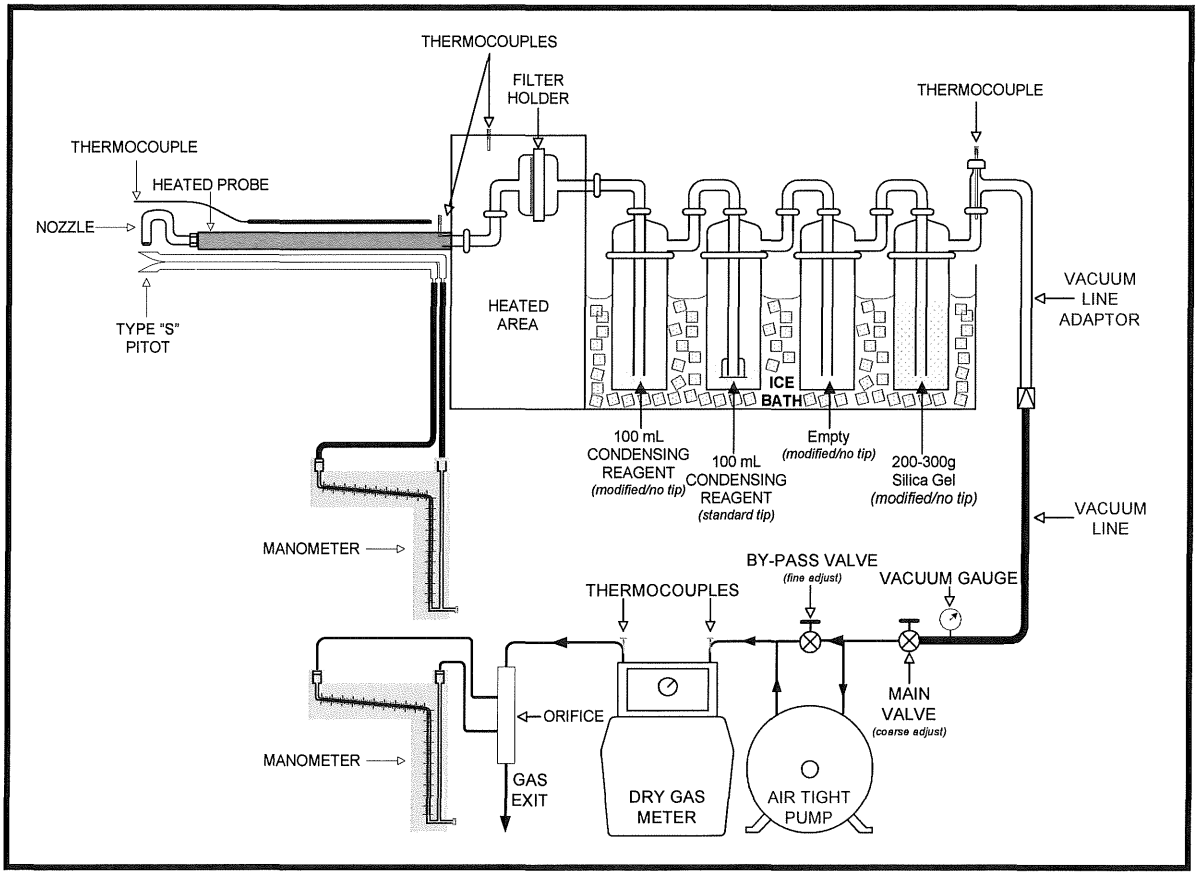
EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Condensed water is measured volumetrically
- Target and/or Minimum Required Sample Duration: 60 minutes
- Target and/or Minimum Required Sample Volume: 21 scf

The typical sampling system is detailed in Figure 3-1.

FIGURE 3-1
EPA METHOD 4 SAMPLING TRAIN



3.1.5 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

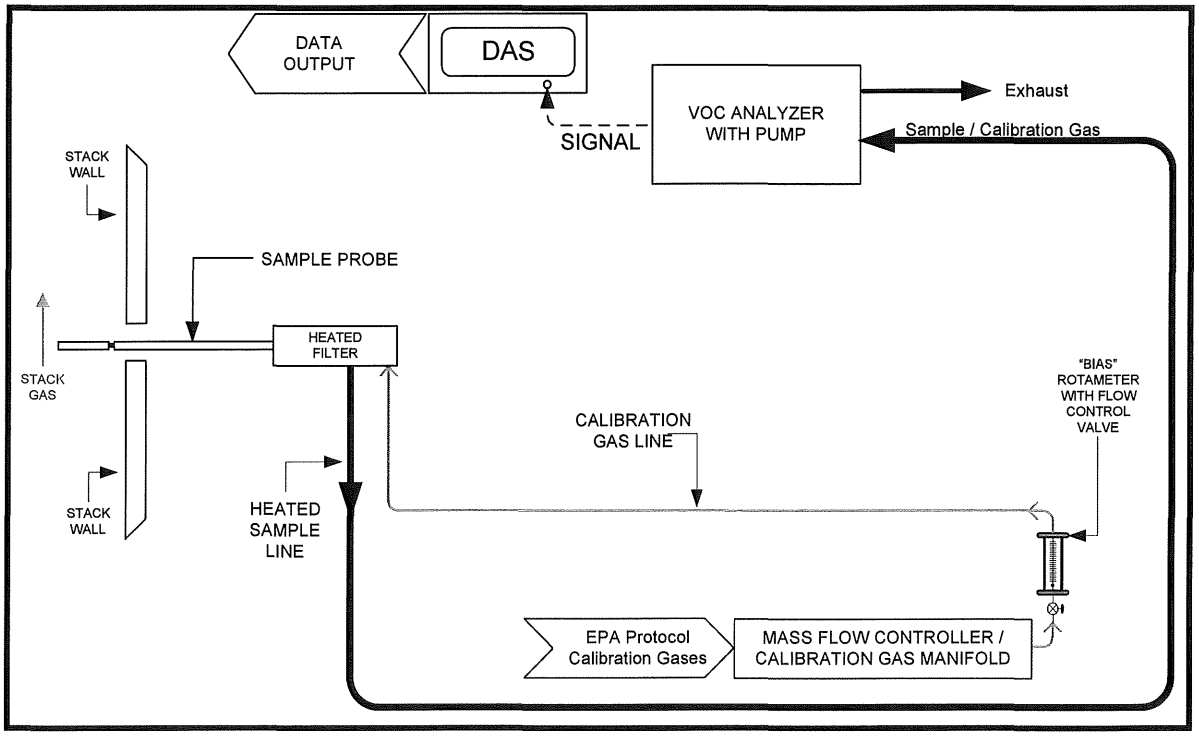
EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Results are reported in terms of propane
  - A dilution system is used to dilute the inlet THC sample (63.6 dilution)
  - Span value is 10,000 ppmvw (inlet) and 100 ppmvw (outlet)
- Target and/or Minimum Required Sample Duration: 60 minutes

The typical sampling system is detailed in Figure 3-2.

FIGURE 3-2
EPA METHOD 25A SAMPLING TRAIN



3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

No field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Tables 4-1 and 4-2. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

TABLE 4-1
THC INLET EMISSIONS RESULTS -
C195

Run Number	1	2	3	Average
Date	12/9/20	12/9/20	12/9/20	--
Time	12:30-13:30	13:48-14:48	15:00-16:00	--
Flue Gas Parameters				
flue gas temperature, °F	174.3	183.4	201.4	186.4
volumetric flow rate, acfm	27.8	31.6	35.6	31.7
volumetric flow rate, scfm	22.6	25.3	27.7	25.2
volumetric flow rate, dscfm	12.2	11.0	4.77	
moisture content, % volume	46.15	56.49	82.77	61.80
THC, as Propane				
ppmvw	91,022	102,526	123,446	105,665
lb/hr	14.1	17.8	23.5	18.5

TABLE 4-2
THC OUTLET EMISSIONS RESULTS -
C195

Run Number	1	2	3	Average
Date	12/9/20	12/9/20	12/9/20	--
Time	12:30-13:30	13:48-14:48	15:00-16:00	--
Flue Gas Parameters				
flue gas temperature, °F	1,261	1,231	1,248	1,247
volumetric flow rate, acfm	3,069	2,909	2,937	2,972
volumetric flow rate, scfm	918	885	885	896
volumetric flow rate, dscfm	853	825	808	829
O_2, % volume dry	13.2	13.1	13.2	13.2
CO_2, % volume dry	4.2	4.3	4.2	4.2
moisture content, % volume	7.15	6.90	8.74	7.60
THC, as Propane*				
ppmvw	< 2.0	< 2.0	<2.0	< 2.0
lb/hr	< 0.013	< 0.012	< 0.012	< 0.012
destruction efficiency, %	99.9	99.9	99.9	99.9

*THC results are calculated using the MDL of 2.0 ppmv (2% of analyzer span).

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter box and sampling train used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes, and minimum sample durations met the applicable QA/QC criteria.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks.

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).